

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

Amendments to the Claims:

1. (Previously presented) A method for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the method comprising:

coupling a current (I_{OUT}) to a common node through a pass circuit that is responsive to a first control signal such that the current (I_{OUT}) is controlled;

coupling the current (I_{OUT}) from the common node through a sense circuit to the load at an output node;

setting a trip-point level with a first resistor circuit and a first current source, wherein the first current source is series coupled to the common node through the first resistor circuit, and wherein the first current source is configured to provide an approximately constant current level;

monitoring a voltage associated with the load to provide a sensed output voltage

comparing the trip-point level with the sensed output voltage;

asserting the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level as indicated by the change in the sensed output voltage relative to the trip point level;

selecting a tap-point in the first resistor circuit in response to a selection signal; and

adjusting the trip-point level associated with trip-point detection signal in response to the selected tap-point in the first resistor circuit.

2. (Original) The method of claim 1, further comprising:

coupling a first input of an amplifier to the output node;

coupling a second input of the amplifier to the first resistor circuit and the first current source; and

providing the first control signal in response to an output of the amplifier.

3. (Previously presented) A method for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold comprising:

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

coupling a current (I_{OUT}) to a common node through a pass circuit that is responsive to a first control signal such that the current (I_{OUT}) is controlled;

coupling the current (I_{OUT}) from the common node through a sense circuit to the load at an output node;

setting a trip-point level with a first resistor circuit and a first current source, wherein the first current source is series coupled to the common node through the first resistor circuit, and wherein the first current source is configured to provide an approximately constant current level;

monitoring a voltage associated with the load to provide a sensed output voltage

comparing the trip-point level with the sensed output voltage;

asserting the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level as indicated by the change in the sensed output voltage relative to the trip point level;

coupling a first input of an amplifier to the output node;

coupling a second input of the amplifier to the first resistor circuit and the first current source;

providing the first control signal in response to an output of the amplifier

coupling a first amplifier to the output node through a second resistor circuit;

coupling a second current source to the output node through the second resistor circuit;

and

adjusting at least one of a current level associated with the second current source and a resistance level that is associated with the second resistor circuit in response to the sensed output voltage.

4. (Cancelled)

5. (Original) The method of claim 1, further comprising: reducing an offset that is associated with the comparison between the trip-point level and the sensed output voltage.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

6. (Previously presented) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first current source that is arranged to provide a first current, wherein the first current has a first level that is approximately constant, and wherein the first current source is controlled;

a first resistor circuit that is coupled between a common node and the first current source, wherein the first resistor circuit has an associated tap-point, wherein the first resistor circuit comprises at least a first resistor and a second resistor that are coupled together at the tap point;

a pass circuit that is coupled between an input source node and the common node;

a sense circuit that is coupled between the common node and an output node;

a comparator circuit that includes a first input that is coupled to the tap-point in the first resistor circuit, a second input that is coupled to the output node, and an output node that indicates the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level.

7. (Original) The apparatus of claim 6, wherein the comparator circuit comprises at least one of: a chopper stabilized comparator, a low-offset comparator, and an auto-zero comparator.

8. (Original) The apparatus of claim 6, further comprising: an amplifier that includes a first input that is coupled to the output node, a second input that is coupled to the first resistor circuit and the first current source, wherein the first control signal is responsive to an output of the amplifier.

9. (Original) The apparatus of claim 8, further comprising: a second resistor circuit and a second current source, wherein the second current source is coupled to the output node through the second resistor circuit, and wherein the first input of the amplifier is coupled to the output node through the second resistor circuit.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

10. (Original) The apparatus of claim 9, further comprising a second amplifier circuit that includes a first input that is coupled to the output node, a second input that is coupled to a reference signal, and wherein the second current source is controlled in response to an output of the second amplifier circuit.

11. (Original) The apparatus of claim 9, further comprising a second amplifier circuit that includes a first input that is coupled to the output node, a second input that is coupled to a reference signal, and wherein the second resistance circuit is controlled in response to an output of the second amplifier circuit.

12. (Original) The apparatus of claim 11, further comprising a feedback circuit, wherein the first input of the second amplifier circuit is coupled to the output node through the feedback circuit.

13. (Original) The apparatus of claim 11, further comprising a feedback circuit, wherein the first input of the second amplifier circuit is coupled to the output node through the feedback circuit, and wherein the feedback circuit corresponds to at least one of: an active scaling circuit, a passive scaling circuit, a voltage divider circuit, a resistor divider circuit, a diode divider circuit, and a capacitor divider circuit.

14. (Original) The apparatus of claim 6, wherein the first resistor circuit comprises: a multiplexer and a tapped resistor circuit, wherein the multiplexer includes inputs that are coupled to common points in the tapped resistor circuit, and wherein the multiplexer is responsive to a selection signal such that one of the common points is selected as the tap point that is associated with the second resistor circuit.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

15. (Currently Amended) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first voltage drop means that is coupled to a common node and arranged to provide a trip-point level at a tap-point, wherein the first voltage drop means comprises:

a resistor means that comprises at least a first resistance means and a second resistance means that are coupled together at the tap point; and

a current source means that is arranged to couple a sense current to the resistor means such that the trip point level is provided at the tap point in response to the sense current;

a pass means that is coupled between an input source node and the common node;

a sense means that is coupled between the common node and an output node;

a comparator means that includes a first input that is coupled to the tap-point, a second input that is coupled to the output node, wherein the comparison means is arranged to assert the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level.

16. (Currently Amended) The apparatus of claim 15, wherein the first voltage drop means comprises a current source means that is coupled to the common node through a resistor means, wherein the current source means is arranged to provide an approximately constant current.

17. (Currently Amended) The apparatus of claim 15-16, further comprising a selector means, wherein the resistor means comprises a series of resistors with a series of common points, and wherein the selector means is arranged to select one of the common points as the tap-point.

18. (Original) The apparatus of claim 15, wherein the sense means comprises a resistor means that is series coupled between the common node and the output node.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

19. (Original) The apparatus of claim 15, wherein the pass means comprises a field effect device that is controlled in constant voltage and constant current modes with respect to the load.

20. (Original) The apparatus of claim 15, wherein the comparator means comprises at least one of: a chopper stabilized comparator, a low-offset comparator, and an auto-zero comparator.

21. (Previously presented) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first current source that is arranged to provide a first current to a first sense node, wherein the first current has a first level that is approximately constant, and wherein the first current source is controlled;

a first resistor circuit that is coupled between a common node and a tap-point;

a second resistor circuit that is coupled between the tap-point and the first sense node;

a pass circuit that is coupled between an input source node and the common node;

a sense circuit that is coupled between the common node and an output node;

a comparator circuit that includes a first input that is coupled to the tap-point, a second input that is coupled to the output node, and an output that indicates the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level;

a third resistor circuit that is coupled between the output node and a second sense node;

a second current source that is arranged to provide a second current to the second sense node, wherein the second current source is controlled in response to changes in a voltage associated with the output node; and

an amplifier circuit that is arranged to provide a variable control signal for the pass circuit, wherein the amplifier circuit has a first input that is coupled to the first sense node, and a second input that is coupled to the second sense node.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

22. (Previously presented) The apparatus of claim 21, further comprising:
a fourth resistor circuit that is coupled between the output node and a third sense node;
a fifth resistor circuit that is coupled to the third sense node;
a second amplifier circuit that is arranged to provide a second variable control signal for
the second current source, wherein the second amplifier circuit has a first input that is coupled to
a reference signal, and a second input that is coupled to the third sense node.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

Amendments to the Claims:

1. (Previously presented) A method for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the method comprising:

coupling a current (I_{OUT}) to a common node through a pass circuit that is responsive to a first control signal such that the current (I_{OUT}) is controlled;

coupling the current (I_{OUT}) from the common node through a sense circuit to the load at an output node;

setting a trip-point level with a first resistor circuit and a first current source, wherein the first current source is series coupled to the common node through the first resistor circuit, and wherein the first current source is configured to provide an approximately constant current level;

monitoring a voltage associated with the load to provide a sensed output voltage

comparing the trip-point level with the sensed output voltage;

asserting the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level as indicated by the change in the sensed output voltage relative to the trip point level;

selecting a tap-point in the first resistor circuit in response to a selection signal; and

adjusting the trip-point level associated with trip-point detection signal in response to the selected tap-point in the first resistor circuit.

2. (Original) The method of claim 1, further comprising:

coupling a first input of an amplifier to the output node;

coupling a second input of the amplifier to the first resistor circuit and the first current source; and

providing the first control signal in response to an output of the amplifier.

3. (Previously presented) A method for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold comprising:

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

coupling a current (I_{OUT}) to a common node through a pass circuit that is responsive to a first control signal such that the current (I_{OUT}) is controlled;

coupling the current (I_{OUT}) from the common node through a sense circuit to the load at an output node;

setting a trip-point level with a first resistor circuit and a first current source, wherein the first current source is series coupled to the common node through the first resistor circuit, and wherein the first current source is configured to provide an approximately constant current level;

monitoring a voltage associated with the load to provide a sensed output voltage

comparing the trip-point level with the sensed output voltage;

asserting the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level as indicated by the change in the sensed output voltage relative to the trip point level;

coupling a first input of an amplifier to the output node;

coupling a second input of the amplifier to the first resistor circuit and the first current source;

providing the first control signal in response to an output of the amplifier

coupling a first amplifier to the output node through a second resistor circuit;

coupling a second current source to the output node through the second resistor circuit;
and

adjusting at least one of a current level associated with the second current source and a resistance level that is associated with the second resistor circuit in response to the sensed output voltage.

4. (Cancelled)

5. (Original) The method of claim 1, further comprising: reducing an offset that is associated with the comparison between the trip-point level and the sensed output voltage.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

6. (Previously presented) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first current source that is arranged to provide a first current, wherein the first current has a first level that is approximately constant, and wherein the first current source is controlled;

a first resistor circuit that is coupled between a common node and the first current source, wherein the first resistor circuit has an associated tap-point, wherein the first resistor circuit comprises at least a first resistor and a second resistor that are coupled together at the tap point;

a pass circuit that is coupled between an input source node and the common node;

a sense circuit that is coupled between the common node and an output node;

a comparator circuit that includes a first input that is coupled to the tap-point in the first resistor circuit, a second input that is coupled to the output node, and an output node that indicates the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level.

7. (Original) The apparatus of claim 6, wherein the comparator circuit comprises at least one of: a chopper stabilized comparator, a low-offset comparator, and an auto-zero comparator.

8. (Original) The apparatus of claim 6, further comprising: an amplifier that includes a first input that is coupled to the output node, a second input that is coupled to the first resistor circuit and the first current source, wherein the first control signal is responsive to an output of the amplifier.

9. (Original) The apparatus of claim 8, further comprising: a second resistor circuit and a second current source, wherein the second current source is coupled to the output node through the second resistor circuit, and wherein the first input of the amplifier is coupled to the output node through the second resistor circuit.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

10. (Original) The apparatus of claim 9, further comprising a second amplifier circuit that includes a first input that is coupled to the output node, a second input that is coupled to a reference signal, and wherein the second current source is controlled in response to an output of the second amplifier circuit.

11. (Original) The apparatus of claim 9, further comprising a second amplifier circuit that includes a first input that is coupled to the output node, a second input that is coupled to a reference signal, and wherein the second resistance circuit is controlled in response to an output of the second amplifier circuit.

12. (Original) The apparatus of claim 11, further comprising a feedback circuit, wherein the first input of the second amplifier circuit is coupled to the output node through the feedback circuit.

13. (Original) The apparatus of claim 11, further comprising a feedback circuit, wherein the first input of the second amplifier circuit is coupled to the output node through the feedback circuit, and wherein the feedback circuit corresponds to at least one of: an active scaling circuit, a passive scaling circuit, a voltage divider circuit, a resistor divider circuit, a diode divider circuit, and a capacitor divider circuit.

14. (Original) The apparatus of claim 6, wherein the first resistor circuit comprises: a multiplexer and a tapped resistor circuit, wherein the multiplexer includes inputs that are coupled to common points in the tapped resistor circuit, and wherein the multiplexer is responsive to a selection signal such that one of the common points is selected as the tap point that is associated with the second resistor circuit.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

15. (Currently Amended) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first voltage drop means that is coupled to a common node and arranged to provide a trip-point level at a tap-point, wherein the first voltage drop means comprises:

a resistor means that comprises at least a first resistance means and a second resistance means that are coupled together at the tap point; and

a current source means that is arranged to couple a sense current to the resistor means such that the trip point level is provided at the tap point in response to the sense current;

a pass means that is coupled between an input source node and the common node;
a sense means that is coupled between the common node and an output node;
a comparator means that includes a first input that is coupled to the tap-point, a second input that is coupled to the output node, wherein the comparison means is arranged to assert the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level.

16. (Currently Amended) The apparatus of claim 15, wherein the first voltage drop means comprises a current source means that is coupled to the common node through a resistor means, wherein the current source means is arranged to provide an approximately constant current.

17. (Currently Amended) The apparatus of claim 15 or 16, further comprising a selector means, wherein the resistor means comprises a series of resistors with a series of common points, and wherein the selector means is arranged to select one of the common points as the tap-point.

18. (Original) The apparatus of claim 15, wherein the sense means comprises a resistor means that is series coupled between the common node and the output node.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

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19. (Original) The apparatus of claim 15, wherein the pass means comprises a field effect device that is controlled in constant voltage and constant current modes with respect to the load.

20. (Original) The apparatus of claim 15, wherein the comparator means comprises at least one of: a chopper stabilized comparator, a low-offset comparator, and an auto-zero comparator.

21. (Previously presented) An apparatus for providing a trip-point detection signal when a current that is delivered to a load decreases below a predetermined threshold, the apparatus comprising:

a first current source that is arranged to provide a first current to a first sense node, wherein the first current has a first level that is approximately constant, and wherein the first current source is controlled;

a first resistor circuit that is coupled between a common node and a tap-point;

a second resistor circuit that is coupled between the tap-point and the first sense node;

a pass circuit that is coupled between an input source node and the common node;

a sense circuit that is coupled between the common node and an output node;

a comparator circuit that includes a first input that is coupled to the tap-point, a second input that is coupled to the output node, and an output that indicates the trip-point detection signal when the current (I_{OUT}) decreases from a current limit level (I_{MAX}) to a predetermined threshold level;

a third resistor circuit that is coupled between the output node and a second sense node;

a second current source that is arranged to provide a second current to the second sense node, wherein the second current source is controlled in response to changes in a voltage associated with the output node; and

an amplifier circuit that is arranged to provide a variable control signal for the pass circuit, wherein the amplifier circuit has a first input that is coupled to the first sense node, and a second input that is coupled to the second sense node.

App. No. 10/810,120
Amendment Dated: November 28, 2005
Reply to Office Action of September 27, 2005

22. (Previously presented) The apparatus of claim 21, further comprising:
a fourth resistor circuit that is coupled between the output node and a third sense node;
a fifth resistor circuit that is coupled to the third sense node;
a second amplifier circuit that is arranged to provide a second variable control signal for
the second current source, wherein the second amplifier circuit has a first input that is coupled to
a reference signal, and a second input that is coupled to the third sense node.